

VI. *Records of Insect Migrations in Tropical America.* By
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[Read March 17th, 1920.] *

IN two previous papers (Trans. Ent. Soc. 1917, pp. 154-164, and 1919, pp. 76-88) I have given as complete accounts as possible of migrations of butterflies in British Guiana and Trinidad respectively, that I had either seen myself or considered sufficiently reliable to be placed on record. No apology is made for this further instalment of records, this time relating to several different insects in several countries, as it is only by the piling up of a sufficient bulk of reliable evidence that any progress can be looked for; and such evidence to be of the greatest value should be available to all and should not be hidden away in private notes or obscure publications.

The following are the migrations described or discussed below :—

LEPIDOPTERA.

PIERIDAE.

- Catopsilia (Callidryas) spp.** Dutch Guiana.
British Guiana.
Trinidad, 1918.
1919. February.
1919. March.
1919. July.
Jamaica, 1910.
Colombia, 1900, 1914.
Panama, 1917.
Costa Rica.
Mississippi, 1917.

White Pierid. Trinidad.

LYCAENIDAE.

Tmolus beon. Trinidad, 1919.

HESPERIDAE.

Calpodus ethlius. Panama, 1917.
U.S.A. and West Indies.

URANIADAE.

- Cydamon leilus.** Trinidad, 1868, 1878, 1891, 1899, 1901,
1912, 1917, 1918, 1919.
British Guiana, 1912.
Barbados, 1901, 1905, 1906, 1912, 1915.
Venezuela, 1917.
Costa Rica, 1917.

DIPTERA.

TABANIDAE.

Venezuela to Trinidad.

Yellow Butterflies off the Coast of Dutch Guiana.

Mr. Ince of Port of Spain, Trinidad, informs me that about three years ago (1915 or 1916), about the month of July, he saw thousands of yellow butterflies flying in a northerly direction past his steamer, which was about twenty miles off the coast of Dutch Guiana (Surinam), between the river Surinam and the river Nikeri, and well out of sight of land. There is no land in the direction in which the butterflies were flying.

Yellow Butterflies in British Guiana.

Dr. Barnes, who was for many years a resident of Berbice, British Guiana, tells me that migrations of yellow butterflies were a regular event there. The butterflies always flew along the coast from south-east to north-west, which is across the prevailing wind.

This is an additional locality to those given in my previous paper (*loc. cit.*, 1917), but fits in with my general conclusions as to the two main directions of flight.

Yellow Butterflies in Trinidad.

1918.

Since the publication of my account of the migration of *Catopsilia statira* in Trinidad in October 1918 (*loc. cit.*, 1919, p. 76) two further records have been obtained, which may be placed here for reference.

They were seen abundantly on several days during the migration flying towards the west in Tucker Valley near Macqueripe (Brash). [Macqueripe is on the north coast, north-west of Port of Spain.] They were also seen passing

over Rio Claro [in the south-central district] for several days, flying from the south-west to north-east.

1919. *February.*

On the 7th February, 1919, Sir Norman Lamont reported to me that he had seen the yellow butterflies again on migration on the Rock-Penal road (a few miles inland from the centre of the south coast). He wrote as follows :

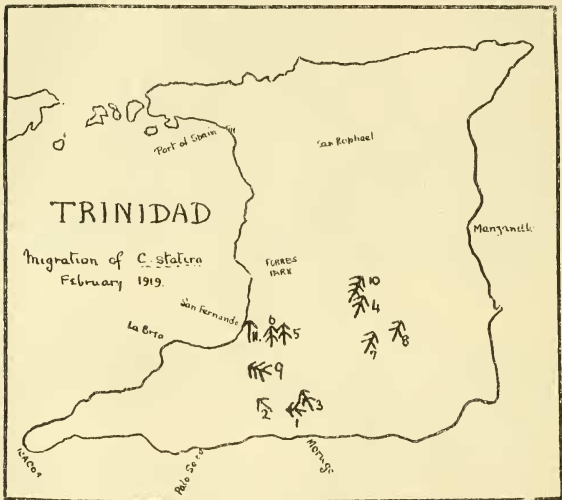


FIG. 1.

“ At 12 o'clock at the junction of the Moreau and Rock-Penal road . . . I noticed a steady stream of yellow butterflies flying east to west with the wind. They were of course high over the tops of the trees, crossing the Moreau road, and were in ones, twos, fives, sixes and eights, but in quite loose order. I remained until two o'clock, and the flight was steady all that time. At two o'clock I started east along the Rock-Penal road, and the butterflies were flying along this road which was parallel to their course, and consequently they were able to fly lower. I

caught two specimens, both females of *C. statira* in absolutely perfect condition, evidently just emerged from pupae."

"At about 2.30 or 2.45 the flight stopped. I was then about the 14th mile post, and in cocoa (the Moreau road is in virgin forest). Weather still sunny as it was throughout. I afterwards went home along the Moruga road, without seeing a single *C. statira* on or crossing the road (Fig. 1, No. 1)."

On the following day (8th February) I went to the localities in question, and found the butterflies still migrating. At 1.40 p.m. a slight but distinct flight was seen going west or north-west at about the fourth mile from Penal on the Rock-Penal road (No. 2). At 2.15 there was a distinct migration towards the north-west at about the 11th mile (No. 3). The numbers passing in successive minutes at this point, on a front of approximately 100 yards, were 16, 14, 2, 1, 25, 14, and 18. At 12 $\frac{1}{4}$ mile (Moreau road) they were also moving in the same direction. A few were seen a mile or so beyond this, but after that they disappeared as had been noted the previous day by Sir Norman Lamont.

On the same day they were seen passing Tabaquite in a direction "35 degrees east of north" by Mr. H. Thompson (No. 4).

During the week commencing Monday 10th, they were reported to be very common flying towards the north at Reform by Mr. Ross (No. 5) and at Tarouba by Mr. Bolton (No. 6), being particularly common on the 12th according to the latter.

On the 13th they were reported flying towards the north-east at Poole by L. Mota (No. 7), and in the same direction at Rio Claro by P. R. B. (No. 8).

On the 14th they were flying west by north on the Debe-Penal road about 3 $\frac{1}{4}$ mile at 11 a.m., at a rate of 350 per minute on a front of 100 yards (C. M. Roach) (No. 9). "A dense drove" passed over Tabaquite between one and two o'clock in a north-east direction (G. H. Wilcocks) (No. 10), and a large number passed over San Fernando flying approximately from south to north (E. A. Turpin) (No. 11).

On the following day I noticed myself a very slight migration in a northerly direction over San Fernando, but this seems to have marked the last effort, as no further records were received.

This migration is of particular interest, for two reasons. In the first place, it is the first authentic record I have obtained of a migration during the dry season. There is one record in my previous paper (1919, p. 88) in which the butterflies were said to be "looking for water," but the date of this was uncertain.

In the present case the migration was preceded by six weeks of extremely dry weather, as in 1919 the dry season in Trinidad started at the very beginning of January.

The second point of great interest is that the direction of the flight was not the same throughout its range, but consisted of a fan-shaped spread from some area near the middle of the south coast, as will be seen distinctly from the directions of the arrows on the accompanying map (Fig. 1).

1919. *March.*

On 15th March, after two and a half months of extremely dry weather, heavy showers fell over the greater part of the island and continued during the following two days.

On the 17th March, at about 12.30 p.m., yellow butterflies were passing along the east side of San Fernando hill in a northerly direction in sufficiently striking numbers to warrant my being informed by telephone of the event.

On the west side of the hill, where my house is situated, they were then seen to be passing in a very thin but steady flight of three or four per minute, but the movement did not last much longer, and was over by 1 p.m.

1919. *Dry Season.*

Mr. Cecil Rostant, a resident of Moruga (south coast), tells me that "some time about the middle of the dry season" the butterflies passed over Moruga in large numbers. They flew to the west during the morning, but in the afternoon turned northward.

It is impossible to say if this record refers to the February migration or not.

1919. *July.*

Mr. J. A. Bulbrook, a geologist who had been in camp at Palo Seco (south coast) for some months, informed me on 29th July, 1919, that since 11th July the butterflies had been passing irregularly from north-west to south-east. He considers the movement not distinct but quite certain.

Yellow Butterflies in Jamaica.

Mr. W. Buthu of the Board of Agriculture, Trinidad, informs me that about the middle of December 1910 he saw a large flight of yellow butterflies at Rockfort, Jamaica (about three miles east of Kingston), flying in a direction approximately north-west. He described the migration as a thin cloud, and estimated, from memory, that about 100 per minute would be passing on a 100-yards front.

Yellow Butterflies in Colombia.

Mr. Rudder, consulting engineer of the Usine St. Madeline, Trinidad, informs me that in April 1900 he saw a large flight of yellow butterflies in the district Darien, Colombia, at an altitude of three or four thousand feet. The butterflies were flying away from the Pacific towards the east, and "one could get fifty in a net at one sweep." The flight only lasted five or ten minutes, during which time the butterflies came down a certain valley, filling the road through the forest. He could not say whether or not they were also over the forest. The flight was a more or less annual event for which they used to look out each year.

I have been unable to find the locality on a map, but Mr. Rudder indicated it as somewhere towards the Panama border and the Pacific.

Canon A. Hombersley of Trinidad gave me the following notes: "Travelling by river steamer down the Magdalena from Giradot to Ambalema [about 100 miles west of Bogota], towards the end of December 1914, for about six hours I noticed, on the mud flats just above the water edge, swarms of white and white-and-yellow butterflies—densely crowded together and quite still, so as to look like white patches about a yard or more in diameter.

"Leaving the boat, I travelled by train the same afternoon to Mariquita; for many miles there is a mud road running alongside the railway—this road was swarming with the same butterflies, which settled in large densely crowded patches wherever there was mud.

"Travelling back over the same railway two or three days after, on 31st December, I visited a cattle ranch and walked some distance through the pasture along the mud road. This was one continuous swarm of the same butterflies and one other variety (orange-red with black lines)

in dense masses wherever the ground was moist. It is strictly accurate to say, that the swarm of butterflies on the wing was so dense for miles that you brushed against them with your clothes as you walked by."

Yellow Butterflies in Panama.

At Bocas del Toro, Panama, I made the two following notes in my diary:—

"6th May, 1917. Yellow butterflies flying steadily across the river at Guabito [on the border between Panama and Costa Rica] from north to south, 8.30 a.m. Fifteen seen in five minutes, and only one flying in opposite direction."

"4th June, 1917. Guabito. Yellow butterflies going due north at 10 a.m. No wind and very hot sun. I saw one hundred or more pass, and none in reverse direction."

Yellow Butterflies in Costa Rica.

Mr. Jemenes, whom I met at Suretka, Costa Rica, informed me that migrations of yellow butterflies are of common occurrence at San José, Costa Rica, and that the butterflies always fly from north to south. This was confirmed by another man in the same house, who had also resided many years at San José.

Yellow Butterflies in Mississippi.

Mr. L. S. Mestier, chemist at the Usine St. Madeline, Trinidad, informs me that about the middle of November 1917 at Ocean Spring, Mississippi, U.S.A., after a cold spell, he saw a large flight of yellow butterflies flying from west to east across a northerly breeze. The flight lasted for about an hour. The butterflies were "by thousands" "like leaves," and were mostly at a height of from six to ten feet.

Mr. Mestier had lived for four years at Ocean Spring (which is on the coast about fifty miles west of Mobile), but this was the first time that he saw any flight of this nature.

White Butterflies in Trinidad.

Mr. Fahey of Industry Estate, Trinidad, says that some years ago he saw a large flight of "small white butterflies" at Manzanilla on the east coast of Trinidad, flying from east to west and coming inland from over the sea.

There is no land to the east of Trinidad, and the only possible explanation of this flight seems to be that the butterflies had migrated out to sea northward from the Guiana or Venezuelan coast, and had been blown westward to Trinidad by the prevailing westerly trade wind.

In a previous paper (*loc. cit.*, 1917, p. 162) I mentioned a record of a flock of the small white Pierid, *Appias margarita*, flying northward out to sea at Berbice, British Guiana, in 1909.

It is extremely unlikely that the two records refer to the same flight, but the latter record at least lends considerable probability to the proposed explanation of the former.

LYCAENIDAE.

Tmolus beon in Trinidad.

On the 23rd March, 1919, I visited the famous Pitch Lake at La Brea, Trinidad [south-western promontory]. At 4.15 p.m. we noticed a large number of small blue butterflies passing in a continuous stream across the open stretches of the "lake," which is largely devoid of vegetation.

The migration was watched for at least a quarter of an hour, and it was in full swing both at the beginning and end of this period, so that it may have lasted much longer.

The butterflies were flying fast and very low, seldom above five feet from the ground, and often less than a foot above it.

They were flying almost due south, slightly S.S.W. The wind was a fairly strong easterly breeze, so that the direction of flight was almost directly across it.

In successive minutes on a 30-yards front the following numbers were counted, 25, 8, 12, 15, 17. The flight was going on as far as one could see in both directions, so that even in the short period that we were watching many thousands must have passed.

I had no net at the time, and only four specimens were caught by knocking down with our hats. Two of these were smashed beyond recognition. The other two were forwarded to Mr. W. J. Kaye, who kindly identified them as *Tmolus beon* Cram., a common Trinidad species. Both were males.

During the period that we watched only three Lycaenids were seen flying in any other direction, and occasionally a yellow butterfly was following the general rush southward.

The weather from January to the middle of March had been excessively dry in this district, but in the second half of March some rain had fallen, which slightly relieved the drying up of the vegetation.

This is the first record, so far as I am aware, of a Lycaenid migrating in this part of the world. There is one account of a migration of a member of this family in India where De Rhe Philippe (*Journ. Bombay Nat. Hist. Soc.*, xiv, p. 481) records that *Polyommatus boeticus* migrates annually to the hills in the early hot weather. I have not seen the paper, which is referred to in Lefroy, "Indian Insect Life," p. 419.

HESPERIDAE.

Calpodés ethlius migrating in Panama.

From 14th February to 25th June, 1917, I stayed at various localities in the district of Bocas del Toro, Republic of Panama, chiefly at a small settlement known as Guabito, which is on the border-line of Panama and Costa Rica about twenty miles inland from the Atlantic (Caribbean) coast.

The country is mostly low-lying forest land with occasional low foot-hills or spurs from the higher land further in the interior, and is partly cleared for banana cultivation.

The rainfall during January and February in 1917 had been a little below the average, but the second week in March was exceptionally wet, and eight inches of rain was registered in twelve hours a few miles from Guabito; for several weeks after this the forest was flooded in many low-lying parts.

On 2nd April I noticed a "moth-like insect" flying in large numbers past the house at about 4 to 4.30 p.m., flying *very rapidly* in a northerly (N.E. to N.W.) direction. It was a hazy afternoon, practically no wind and the sun just visible through thin clouds.

On the following day (3rd April) at 4 p.m. the same insects were again passing " ? in all directions." At 5 p.m. they were still flying in a slight rain.

Two specimens were captured, and proved to be a skipper (Hesperid) butterfly, since identified by Prof. E. B. Poulton as *Calpodés ethlius* Cramer.

On the following day (4th April) a careful watch was kept, but none were seen either in the morning or evening.

On the 5th April at 4.15 p.m. they were again flying in

thousands past Guabito Station at a great speed, going towards the east or south-east. About a quarter of an hour later at a spot about half a mile north of the railway station, and just over the border into Costa Rica, they were flying due east in enormous numbers—300 or 400 per minute on every 100-yards front.

Nothing was seen of them again for over a month, but in the interval I questioned Mr. Ladd, a local amateur naturalist, who said that he had frequently seen them, that they only flew in the late afternoon and evening, and that *they changed the direction during the evening*, flying at first in one direction and later all returning in the opposite.

Several other residents agreed as to the frequency of their appearance, and a Mr. Weaver who lived several miles north of Guabito at Paraiso, Costa Rica, said that they always flew in the late afternoon and from north to south.

On 10th May at 4.45 p.m. I again noticed them passing the house three or four per minute in almost every direction, but possibly more from north-east to south-west than any other way. By 6 p.m. when it was getting dusk they were still flying, and were possibly more common in a reverse direction but not distinctly so. It was again slightly cloudy after a hot day and no wind. Temperature at 6 p.m. 78° F.

On 24th May they were again passing in the evening, with a thinly clouded sky after a hot day with no wind.

At 4.50 p.m. they were first noticed in numbers, almost all going to the south or south-west past the house. At 5 p.m. very few were seen. At 5.5 another lot appeared, this time going towards the north and north-west. From 5.40 to 6 they were passing in almost every direction, but chiefly towards the north or towards the south.

By 6 o'clock it was dusk, and the butterflies were difficult to see except as shadows against the light. By lying on my back on the ground I was able to count those passing within my range of vision. In successive minutes 30, 48, 40, 33, 40, 35, and 32 were counted. "About equal numbers going to the north-west and the south-east, but very few in any other direction." At 6.30 it was almost dark, and none were seen.

Three more specimens were captured to-day.

The height of the flight was about three to twenty feet above the ground and the speed was very great, at least twenty miles an hour if not much more. It was sufficiently

great to make it quite impossible for me to tell to what family or even to what order the insect belonged until one was captured, and over one hour's continuous effort to capture specimens, passing sometimes almost every second, only resulted in the capture of five individuals.

Prof. Poulton informs me that all these five specimens were females.

This concludes my own observations on the insect, as it was not seen again during my stay in the district.

To summarise :—The butterfly flew in large numbers, at a great speed, in various directions, but chiefly from north or north-west to south or south-east and vice versa, in the late afternoon and evening * of cloudy, close, still days during April and May with a very slight indication of a change in direction as the evening progressed. In addition all the specimens captured were females.

It may be maintained that a flight of this nature is not a true migration, and it is possible that this is so. At the same time it is a flight which differs distinctly from the normal fluttering of the insect round flowers, and as such would be worthy of record. There are, however, certain known observations with regard to this insect which make it probable that this habit, if not always truly migratory, may sometimes at least lead to a migration.

Calpodex ethlius feeds in its larval stage on the leaves of *Canna*. Its distribution is from S. Carolina to the Argentine Republic, but it appears to be unable to survive the winter much further north than Florida. On occasions, however, the insect appears in large numbers as far north as the district of Colombia, and rarely even as far as Long Island, New York.

F. H. Chittenden (U.S. Dept. Agric. Bur. Ent., Circular 145 (1912), pp. 1-2) gives some particulars of an invasion in September 1904, when thousands of caterpillars were destroying cannas in Alabama, and in the following year, 1905, when they reached as far as Washington D.C. He writes (p. 2): "The cause of this invasion was apparently that the summer of 1905 was an unusually hot one. Heat favours an increase of insects of this type. Prevailing southerly winds, however, were probably more potent

* Chittenden (U.S. Dept. Agric. Bur. Ent., Circular 145, p. 7) says, "Wittfield adds that one of the favourite times for flight of the butterfly in fair weather is after sundown," but I have been unable to trace the original reference.

factors in causing this migration from the Gulf Region northwards, since the summer of 1906 was still warmer, but with much greater humidity, and under these conditions only one pupa was found during that entire year."

In 1911 there was another invasion, which reached as far as Long Island, of which the following particulars were kindly given to me by Mr. F. E. Watson of the American Museum of Natural History. He tells me that two specimens, one battered and one in fair condition, were captured during May 1911, one on Long Island and one in Prospect Park, New York City. During August all the cannas in the parks in this district were eaten up by thousands of larvae, from which pupae were obtained which gave *indoors*, adults in October and November, but out of doors no adults were seen either that autumn or the following year.

There can be no doubt that these sudden extensions of range were brought about by some form of migratory flight.

In Trinidad and the West Indies the butterfly is generally abundant, sometimes sufficiently so as to rank as a pest of canna and arrowroot, particularly in St. Vincent.

During three years' residence in Trinidad I have never seen any migratory movement of this butterfly or any flight in any way resembling that seen in Panama. On the other hand, the sudden appearance of the insect in large numbers in some of the smaller islands, indicates very strongly that these migratory movements take place here also. In the West Indian Bulletin, vol. 3, 1902, p. 234, *Calpodès ethlius* is mentioned in an article on insect epidemics as an example of an insect which is liable to very sudden increase in numbers, only later to decrease equally suddenly. No suggestion is however made that the outbreak might be due to migration.

There was a severe outbreak of the pest in St. Vincent in 1900 and again in September 1901, the latter being the occasion of a short investigation by H. M. Lefroy, then entomologist to the Imperial Department of Agriculture for the West Indies.

In "Indian Insect Life," p. 421, Lefroy says: "From time to time one reads in newspapers of a swarm of butterflies having been seen flying steadily in a particular direction. We have seen this in the case of the West Indian skipper (*Calpodès ethlius*) which was extremely abundant."

No further particulars are given, but in answer to an inquiry Prof. Lefroy kindly sent me the following information: "My reference was badly worded in 'Indian Insect Life.' I saw the case myself in St. Vincent when I was proceeding in the 'passage boat' along the coast from the port [Kingston] to the neighbourhood of Soufrière. I was then after the arrowroot skipper, and noted this migration, many butterflies flying steadily from the land over the sea in one direction. I have forgotten the geography, but I imagine they were flying east."

With the help of Mr. H. A. Ballou I have seen Lefroy's original report on this visit to St. Vincent, in which he says: "I observed many flying over the sea at a distance of half a mile from the shore, proceeding along the coast. Large numbers were flying about the fields and roads, and they could be seen laying eggs in the fields of arrowroot" ("St. Vincent Gazette," 27th September, 1901).

Another outbreak of this insect is referred to in the "Report of the Department of Agriculture in St. Vincent for the year ending 31st March, 1907," p. 13, where it is stated: "The cultivation suffered a good deal during the early part of the year [? 1906] from attacks of the arrowroot worm." One estate is mentioned as having its yield reduced from 700 to 500 barrels of starch.

In the report of the same Department for 1912-13, p. 15, it says: "In most fields seen the degree of infestation was not severe, nor were the adults observed in great numbers except on one field on the windward side, where in passing in the early morning enormous numbers of adults were seen flying."

This note is of considerable importance in connection with the previously mentioned records of its flight at dusk, and these unusual hours of flight might account for the lack of more frequent records of its movements.

In 1913-14 the insect "was in evidence, but did little damage." In 1914-15 "Arrowroot was again attacked somewhat severely in the Leeward district" (Report 1914-15, p. 8), and in 1915 the insect caused extensive defoliation in some districts. "After a time large numbers of parasites appeared, and there was a gradual reduction in the pest until none were seen. The first outbreak occurred in May 1915, and the parasites reared comprised three species of Tachinid flies. No egg parasites were discovered during this outbreak. A second outbreak followed in

August, and on this occasion control was finally effected by an unidentified egg parasite, the Tachinids being rare" (St. Vincent Rept. of the Agricultural Department for 1915-16, p. 17).

In 1919 S. C. Harland, who has studied the life-history of the insect in St. Vincent, wrote to me as follows: "*Calpododes* was very abundant in St. Vincent for several months in 1916, but never abundant at the Experimental Station since. Apparently the eggs are parasitised as soon as laid. I can find the eggs all the year round, but they don't seem to hatch except at certain periods. This year, 1919, I noticed attacks on the windward coast. I have never seen any migration. I don't think that migration from island to island comes into play at all. We have more of its food-plant here than any other island, and it may be possible that the mature insects fly northward."

Harland is of the opinion that the sudden outbreaks are due to temporary lack of parasites rather than to migration. We have, however, positive evidence of the migration of this butterfly and, in spite of Mr. Harland's remarks, I think that it will be found to be the explanation of many of the outbreaks of the insect in the West Indies. The rapid reduction of the outbreaks may be explained by the abundance of the parasites, but to explain the original increase of the insect by a decrease in the parasites puts us only one stage back in the inquiry. Doubtless the unusual hours of flight and the high speed attained has caused many migrations to be overlooked, or, when seen, to be confused with some other insect.

CYDAMON LEILUS.

Cydamon leilus in Trinidad.

The day-flying moth *Cydamon (Urania) leilus* is well known for its migratory habits. Isolated records of its migrations are scattered through entomological literature. I have given below all the information that I have been able to obtain with regard to its occurrence in Trinidad. Some of the records have been published before, but mostly in obscure local periodicals. The particulars for the years 1917, 1918, and 1919 are from my own observations.

1868. H. Caracciolo in the Journal of the Trinidad Field Naturalists' Club, vol. i. (1892-1894), p. 16, says that

C. leilus was very common about the year 1868, but was rare for the next ten years.

1878. According to the same authority (*loc. cit.*) the moth was again abundant in 1878. He describes how in October of that year "on Forres Park Estate, Claxton Bay, hundreds of these *Urania* filed soldier-like over the roof of my hut in one continuous string from 4 to 6 p.m., flying in a Southerly direction. Where could they be going to? They were evidently on a long journey, for I watched them as far as the eye could reach, and saw them passing over several of our small hills without interrupting their course. It is quite possible that they were emigrating, for their course being southerly they would reach Icacos [south-western promontory], and from there return to Venezuela across the Serpent's Mouth. Since then I have not seen them in such large quantities; they appear every year, but in smaller numbers."

1891. Caracciolo (*loc. cit.*) writes: "One day last September [1891] I observed them very closely. They were passing over the roof of the customs house, and flying about three feet over the surface of the sea. Occasionally they would swoop down and tip the surface of the water. Since writing the above Mr. Guppy assures me that he came across one by Caledonia Island floating on the sea." No direction of flight is given in this account.

1899. In a letter, Mr. T. I. Potter informs me "the most important migration of *C. leilus* that I can remember was that of 1899, July to October. The day-moths flew in thousands from N.W. to S.E. at Brighton—apparently crossing the gulf from Venezuela. They were very common on the Queen's Park Savannah [Port-of-Spain] that year, also flying from N.E. to S.W. in the morning and vice versa in the evening." "I cannot now recollect whether they reversed their flight at Brighton in the afternoon, and I don't think I noticed this. I know they flew down there very late in the evening, because I used to catch specimens on my dining-table after dark."

1901. In this year the moth again appeared in large numbers. P. L. Guppy (*Trans. Ent. Soc.*, 1907, pp. 405-410) has given some notes on this migration from which the following extracts are taken:—

"From the early part of September we had them here by thousands, lasting for about five weeks." . . . "Flying both eastward and westward and seen a mile out at sea"

(Mr. E. Johnstone, San Fernando). "Flew in thousands past the pier" (Mr. Potter, La Brea).

Mr. Guppy says the moth is generally common about July and August, abundant in September, and by October only solitary examples are seen. He found eggs and caterpillars in Trinidad, and was thus able to show that the island is not entirely dependent for this insect on migrations from the mainland.

"Since 1901 they have not been common" (Guppy, *loc. cit.*, written in 1906).

1912. On the 4th September of this year Mr. C. M. Carmona of San Raphael wrote to Mr. F. W. Urich as follows: "Since this morning a large amount of butterflies has been passing over here at an altitude of 60 or 70 feet, and increasing in numbers more and more. They are coming from the south and going straight north." Some of the "butterflies" were enclosed, and were identified by Mr. Urich, to whom I am indebted for the record, as *Cydamon leilus*.

In this year the moth appeared in numbers in Barbados and British Guiana (see below).

1917. I was in Trinidad in the fall of 1916, but did not notice any unusual abundance of *C. leilus*. In 1917, however, a very distinct migration took place, of which I give the following records from my own notes.

On 11th September a number of isolated specimens were seen throughout the day at La Fortunée (about six miles south of San Fernando) all flying towards the north-east quarter.

On the following day (12th September) at Malgretout (about six miles east of San Fernando) isolated specimens were again seen flying in the same direction. About 40 specimens were seen during the day.

On the 13th September at Tarouba (two miles east of San Fernando) they were still flying in the same direction in small numbers.

From this date until the 23rd I was unable, owing to illness, to make any observations, but I was given to understand that the moths continued to fly at Tarouba in about the same numbers; and an officer of one of the motor patrol boats informed me that he saw them flying over the sea at Cedros in the same direction.

On the 25th September they were again seen at Tarouba passing in much greater numbers, all going north-east

against a strong easterly wind. Forty were counted in five minutes crossing a front of about 100 yards. The wind was so strong that the butterflies were caught in eddies at the edges of fields of tall sugar-canes, and a large number would be sheltering in such spots only to take the first opportunity to escape and continue their journey in the right direction.

After this the migration continued, according to the manager of Tarouba estate, in diminishing numbers for some days, but on the 5th October, when I next visited this locality, only a single specimen was seen, although this belated example was nevertheless hurrying in the same direction as the others.

Mr. Fahey of Palo Seco (south coast) informs me, without being able to give exact dates, that the moth was abundant in his district, flying from south to north from over the sea for days and days.

Although he has resided for some years in the district he has never seen any flight in the reverse direction.

Dr. E. R. de Verteuil, a resident of the same district, says on the contrary that he has seen them flying from Trinidad to Venezuela, but cannot recall the year or month.

1918. There was apparently no migration of *C. leilus* to Trinidad in this year. I saw the moth at intervals during the year at the following places and dates:—May 14th, Arima-Blanchisseuse road, three specimens. June 16th, Siparia, two specimens. July 11th, La Fortunée, one specimen. August 1st, La Fortunée, one specimen flying east (P. Creteau). September 11th, La Fortunée, one specimen flying west (P. Creteau). September 25th, Caroni, one specimen. October 20th, Palo Seco, one specimen. November 18th, Hermitage, one specimen flying north-east.

1919. The same remarks apply to this year also. Individual specimens were seen as follows:—February 8th, Rock-Penal road. July 15th, Harmony Hall. July 27th, Maracas Valley (Northern Range). July 29th, Maracas Valley and Caroni. September 8th, Hermitage, one flying rapidly north-east.

Cydamon leilus in British Guiana.

In Timehri (The Journ. of the Agricultural and Commercial Soc. of British Guiana) 3rd Series, vol. ii. (December 1912), p. 402, H. W. B. Moore records *C. leilus* as being

abundant all along the Coast of British Guiana from Berbice to Essequibo from June to August of 1912. This record is inserted here, as we have seen that in 1912 they were also present in numbers in Trinidad, and also as, being in an obscure journal, it is likely to be overlooked by other observers.

I was in British Guiana from June to September 1916, and only have recorded a single specimen at the mouth of the Waini river on 14th June.

Cydamon leilus in Barbados.

1901. In the Agricultural News of the West Indies (Barbados), vol. i, No. 4 (June 7th, 1902), p. 56, there is an unsigned article on the "Blue Page Moth" from which the following is taken: "During the gale that reached Barbados and St. Vincent on August 26th, 1901, numbers of a large moth were found in Barbados of a kind not previously known to breed there. They had evidently been brought by the high south-west wind. Some were caught and were identified as *Urania sloanei* [see below], the 'blue page' of Trinidad, and they had apparently come from the mainland or more probably from Trinidad itself. They were found as far north as Dominica, and one was caught on R.M.S. 'Eden' half-way between St. Lucia and Barbados. . . . The direct distance from Trinidad to Barbados is about 160 miles, and to Dominica some 100 miles more."

On p. 168 of the same journal is a note to say that the identification was wrong, and that the species was *Urania (Cydamon) leilus*.

1905. There is a specimen in the collection of the Imperial Department of Agriculture for the West Indies labelled "Barbados, August 1905." See also under 1906.

1906. In the Agricultural News (Barbados), v. No. 117, 20th October, 1906, is the following note: "At the present time a moth is being found in Barbados which was noticed in that island during the gale of 26th August, 1901. This is the Green Page Moth (*Urania leilus*). . . . About a year ago several specimens were caught in Barbados, and it seems probable that it is breeding here." This last deduction is almost certainly incorrect.

1912. In the card index of the Barbados Department of Agriculture is a note to the effect that the insect was

seen in numbers on July 31st, 1912, at Carrington (St. Phillips), after a gale from the south. I am indebted to Mr. Bovell, Director of Agriculture, for this record.

Mr. Nowell, of the Imperial Department of Agriculture, informs me that the insects of this migration were all rapidly eaten up by the local species of Tyrant Fly-catcher (*Tyrannus rostratus* Sclater).

1915. There is a single specimen in the collection of the Imperial Department of Agriculture labelled "Barbados, August 1915."

It has been pointed out that in two of these years (1901 and 1912) in which they occurred in numbers in Barbados they were also recorded as abundant in Trinidad.

Cydamon leilus off the Coast of Venezuela.

On 15th January, 1917, I saw a specimen of this same moth flying over the sea about four miles from the coast and about 100 miles west of Trinidad.

Cydamon leilus in Costa Rica.

On 4th March, 1917, I noticed a distinct migration of this insect at Suretka, Talamanca, Costa Rica (near the Atlantic coast and the Panama border). At 4.15 p.m. they were seen in numbers all going very fast towards the west (up the river). There was at the time a slight north-east breeze and the sky was overcast. Three specimens were captured, of which two were females and one a male. They were passing from 4.15 to 5 p.m. Two were seen at 5.15, and the flight probably continued a little after this.

At 8.45 a.m. on the following day, still cloudy, one was seen flying in the same manner in the same direction, but I left the locality a few minutes afterwards and saw no more.

On the 20th of the same month I saw a single specimen flying full speed in the same direction at Guabito, which is about twenty miles east of Suretka and just over the border-line into Panama.

Mr. Jemenes, who had lived near Suretka for some years, informed me that the migrations of this moth were frequent and usually from north to south, and that in the district of San José, Costa Rica, where he had also lived, he had seen migrations in the same direction.

*Migration of Tabanidae (Diptera) from Venezuela to
Trinidad.*

Dr. E. de Verteuil, who lives at Palo Seco on the south coast of Trinidad, informs me that some years ago, about the end of June or beginning of July, he was out boating about two miles off the south coast, and large numbers of horse-flies (*Tabanidae*) were seen flying full speed over the water towards Trinidad.

The Venezuelan coast is at this point about twelve miles away.

The above records make not the slightest claim to completeness, particularly with regard to references to other published records. In Trinidad many of the best-known periodicals are not available, and those references that are given are quoted largely from the local journals in order to bring them more readily before the student of insect migration.

TRINIDAD. *December 1919.*